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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/058,426	01/30/2002	Daisuke Komada	020060	4298

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EXAMINER

BARRECA, NICOLE M

ART UNIT PAPER NUMBER

1756

DATE MAILED: 06/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/058,426

Applicant(s)

KOMADA ET AL.

Examiner

Nicole M. Barreca

Art Unit

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 April 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-10, 13 and 14 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 2-10 is/are allowed.
- 6) ☒ Claim(s) 1, 13 and 14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

### DETAILED ACTION

1. Claims 1-10, 13 and 14 are pending in this application.

#### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Passemard (US 6,24,053) in view of Liu (US 6,717,194) and Ring (US 6,475,889).
4. SiOCH layer 32 (first film) is formed over semiconductor substrate. SiCH layer 33 (second film) is formed on layer 32. Photosensitive film 40 is deposited and etching hole 41 is defined. A hole is etched in the SiCH layer 33 with layer 32 serving as a stop or barrier, corresponding to the applicant's step of etching the second film using the resist mask as an etching mask. This is followed by removal of the photosensitive layer. While Passemard is silent on the method used to remove the resist and does not disclose using ashing to remove the resist, ashing is a conventional resist removal step known in the art. This is taught by Liu. Liu teaches that once a hole is etched, a conventional oxygen asher is typically used to remove the photoresist layer (col.2, 10-16). It would have been obvious to one of ordinary skill in the art to remove the resist layer in the method of Passemard using ashing because Liu teaches that ashing is a typical photoresist removal method conventionally used in the art. The etching is continued through layer 32. Since the photoresist layer has been removed the

patterned second film of SiCH would have to be used as mask to etch the underlying first film 32. Passemard is silent on the gas mixture used to etch the second film and does not disclose that the second film of silicon carbide is etched using a fluorocarbon gas added with one of SF<sub>6</sub> and NF<sub>3</sub>. Ring teaches that conventional methods of etching silicon carbide include using NF<sub>3</sub> or SF<sub>6</sub> diluted with Ar and CF<sub>4</sub>/O<sub>2</sub> (col.10, 23-25). It would have been obvious to one of ordinary skill in the art to etch the silicon carbide (second film) in the method of Passemard (in view of Liu) using a fluorocarbon gas added with one of SF<sub>6</sub> and NF<sub>3</sub> because Ring teaches that conventionally silicon carbide is etched using NF<sub>3</sub> or SF<sub>6</sub> diluted with Ar and CF<sub>4</sub>/O<sub>2</sub>.

5. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Passemard in view of Liu and Ring as applied to claim 1 above, and further in view of Dabbaugh (US 6,362,094).

6. Passemard is silent on the method of deposition of the SiCH layer and does not disclose that the silicon carbide film is deposited by CVD using tetramethylsilane and carbon dioxide in a flow rate ratio of 0.2 to 0.6. Dabbaugh teaches a semiconductor manufacturing method using silicon carbide. Dabbaugh teaches that the silicon carbide layer may be conventionally formed using plasma enhanced CVD using a silane source and an oxygen source. Tetramethylsilane may be used as the silane source, while carbon dioxide layer be used for the oxygen source (col.3, 47-67). It would have been obvious to one of ordinary skill in the art to deposit the silicon carbide layer by CVD using tetramethylsilane and carbon dioxide because Dabbaugh teaches that this a known method for deposition of hydrogenated silicon carbide. Dabbaugh is silent on

the flow rates of the source gases and does not disclose that the tetramethylsilane and the carbon dioxide flow rates are in a ratio of 0.2 to 0.6. Source gas flow rates are known in the art to be result-effective variables. It would be within the ordinary skill of one in the art to determine the optimal flow rates ratio for the tetramethylsilane and carbon dioxide in the methods above by routine experimentation and to have the ratio be 0.2 to 0.6, if required, because source gas flow rates are result effective variables and the discovery of an optimum value of a result-effective variable is ordinary within the skill of the art, as taught by *In re Boesch* (617 F.2d 272, 205 USPQ 215 (CCPA 1980)).

7. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Passemard in view of Liu, Ring and Dabbaugh as applied to claim 13 above, and further in view of Lu (US 6,730,597).

8. Passemard uses SiOCH as the first film and does not disclose that the first film is made of fluorinated glass. However fluorine doped silicate glass (FSG) and organo-silicate glass (OSG or SiOCH) are both dielectrics known and used in the art for interlayer dielectric layers, as taught by Lu (col.3, 40-46). It would have been obvious to one of ordinary skill in the art to use FSG instead of SiOCH for the first film in the method of Passemard because Lu teaches that both are dielectrics known and used in the art for interlayer dielectric layers.

***Allowable Subject Matter***

9. Claims 2-10 are allowed.

10. The following is a statement of reasons for the indication of allowable subject matter: the prior art fails to teach or suggest a method for manufacturing a

semiconductor device comprising the steps in the order as recited in the applicant's claims, including etching first and/or third films of hydrogenated silicon carbide using a fluorocarbon and one of SF<sub>6</sub> and NF<sub>3</sub> and etching a second film of insulating material having a different etching resistance from silicon carbide.

### ***Response to Arguments***

11. Applicant's arguments, see p.2-3, filed 4/21/05, with respect to Olsen have been fully considered and are persuasive. The 35 USC 102 rejection of claim 1 has been withdrawn.

12. Applicant's arguments with respect to Passemard have been fully considered but they are not persuasive. The applicant argues that Passemard does not ash and remove the resist and etch the first film using the second film as a mask. Passemard teaches that the resist is removed in col.6, 40-41. Ashing is a conventional resist removal process as taught by Liu and discussed in the rejection above. Since the photoresist layer has been removed prior to etching of the first film, the patterned second film of SiCH would have to be used as mask to etch the underlying first film 32.

### ***Conclusion***

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicole M. Barreca whose telephone number is 571-272-1379. The examiner can normally be reached on Monday-Thursday (9AM-7PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nicole M Barreca  
Primary Examiner  
Art Unit 1756



6/15/05